



THE UNIVERSITY *of* EDINBURGH

Edinburgh Research Explorer

Interpersonality: Individual differences and interpersonal priming

Citation for published version:

Gill, AJ, Harrison, AJ & Oberlander, J 2004, Interpersonality: Individual differences and interpersonal priming. in *In Proceedings of the 26th annual conference of the*. pp. 464-469.

Link:

[Link to publication record in Edinburgh Research Explorer](#)

Document Version:

Early version, also known as pre-print

Published In:

In Proceedings of the 26th annual conference of the

General rights

Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact openaccess@ed.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.



Interpersonality: Individual differences and interpersonal priming

Alastair J. Gill (A.Gill@ed.ac.uk)

School of Informatics, University of Edinburgh
2 Buccleuch Place, Edinburgh, EH8 9LW UK

Annabel J. Harrison (annabelh@cogsci.ed.ac.uk)

School of Philosophy, Psychology, and Language Sciences, University of Edinburgh
7 George Square, Edinburgh, EH8 9JZ UK

Jon Oberlander (J.Oberlander@ed.ac.uk)

School of Informatics, University of Edinburgh
2 Buccleuch Place, Edinburgh, EH8 9LW UK

Abstract

We study how Extraversion and Neuroticism influence people's language production in interpersonal interactive situations. A priming study used confederate priming methodology to investigate syntactic priming behaviour. We expected that Extravert sociability would be related to the strength of priming effects, although Neurotic emotionality might also have an effect. Results indicate that Extraversion has no effect, but Neuroticism does have an effect. We discuss possible reasons and suggest further experimentation to investigate this finding. Implications and applications of this work are outlined.

Personality and interaction

Individuals differ in the way they speak and write. Some of those differences are systematic, and can be attributed to apparently deeper differences, such as personality traits, like Extraversion and Neuroticism (or Emotional Stability). Level of Extraversion is intuitively related to sociability and communication, and this is expressed through interpersonal behaviour. However, level of Neuroticism appears to be more related to anxiety and inward focus, and thus having greater influence on solo behavior. In the past, it has been found that both these personality traits do significantly influence an individual's language production behaviour in a variety of contexts (Pennebaker and King, 1999; Dewaele and Furnham, 1999). Recent work has investigated e-mail text, and suggested that even in that genre, there are characteristic sequences of words associated with each end (High or Low) of both dimensions (Extravert or Neurotic) (Gill and Oberlander, 2002, 2003b).

The majority of work on the relations between personality and language production has studied monologue only. Yet most everyday language occurs in the context of interpersonal interaction. So here, we aim to investigate the role of personality upon language use in a dialogue setting.

Studies of conversational behaviour have demonstrated that individuals align with their interlocutors on a number of levels (Pickering and Garrod, in press). The phenomena have been examined from

both social and cognitive perspectives. On the social side, a key focus of interest is cooperation and audience design. On the cognitive side, a key focus is coordination and interpersonal priming.

For example, sociolinguistic studies have shown that speakers adopt accent or dialectal variation or a level of lexical density appropriate to their audience. This variation operates at phonological, lexical, and syntactic levels (Labov, 1972; Coupland, 1980; Bell, 1984; Bradac and Wisegarver, 1984). Audience design is regarded as a relatively conscious process over which the speaker has a certain amount of control. It may be a result of co-operativity, affiliation, or willingness to take another's perspective (Haywood, Pickering, and Branigan, 2003).

By contrast, from a cognitive perspective, coordination is viewed as an artifact of the underlying language production mechanisms. For example, it has been argued that references from the comprehension system are recycled to provide output for the production system (Pickering and Garrod, in press). Alignment is found at the lexical level (Brennan and Clark, 1996; Branigan, Pickering, and Cleland, 2000), the conceptual level (Garrod and Doherty, 1987), and the syntactic level (Pickering and Branigan, 1998). Unlike cooperation, such coordination is considered to be largely subconscious.

Coordination therefore provides a more direct insight into underlying processing abilities, and is less prone to outside influence. In approaching the study of personality in dialogue, we therefore use an interpersonal priming paradigm. At the outset, our question is very general: Can differences in interpersonal priming be attributed to personality?

To make this question more specific—and to attempt to answer it—the rest of this paper is structured as follows. First, we introduce a little more background on personality theory. Then, we frame a possible explanation of recent findings on the relations between Extraversion, Neuroticism and language production; this leads to two hypotheses concerning the possible relation between personality and interpersonal priming. We then present the priming experiment which tested these hypotheses. The results were somewhat unexpected, and we conclude by discussing their implications.

Overview

There are a number of approaches to personality (Matthews and Deary, 1998). Two of the most prominent trait theories are the five factor model (Costa and McCrae, 1992), and Eysenck's three-factor PEN model (Eysenck, Eysenck, and Barrett, 1985; Eysenck and Eysenck, 1991). These agree that two main factors are Extraversion (sociability) and Neuroticism (emotional stability). The Five Factor Model sees three further dimensions: Conscientiousness, Agreeableness and Openness; PEN arguably conflates these into one dimension, Psychoticism (tough mindedness). In what follows, we focus on the first two dimensions, common to both models.

The traits can be summarised thus: A typical Extravert tends to be sociable, needs people to talk to, craves excitement, takes chances, is easy-going, and optimistic. By contrast, a typical Introvert (Low Extravert) is quiet, retiring, reserved, plans ahead, and dislikes excitement; A typical High Neurotic tends to be an anxious, worrying, moody individual. A typical Low Neurotic tends to be calm, even-tempered and relaxed (Eysenck and Eysenck, 1991).

Personality and language

Work on personality and language behaviour has studied a range of features. For instance, Extraverts are regarded as talking louder (Scherer, 1978), demonstrating a higher speech rate (Siegmán, 1987), and they show less hesitation, but make a higher proportion of semantic errors (Dewaele and Furnham, 2000). At a grammatical level, Extraverts use greater proportions of pronouns, adverbs, verbs (Cope, 1969), which contrasts with the more explicit language of the Introverts and their increased use of nouns, modifiers and prepositions (Dewaele and Furnham, 2000). Additionally, Extraverts demonstrate lower lexical richness in formal situations (Dewaele and Furnham, 2000), whilst analysis of informal e-mail communication has shown highly Neurotic language to be more repetitious (Gill, 2003; Gill and Oberlander, 2003b). At a more content-oriented level, Pennebaker and King (1999), using the Linguistic Inquiry and Word Count text analysis program, showed that broad psychological language categories are related to dimensions of personality variation. For example, they found that when writing about thoughts and feelings, high Neurotics use more negative emotion words and fewer positive emotion words.

However, our interest here is on interaction: dialogue and conversation. Studies using speech act coding have found that Introverts used more hedges and problem talk, namely expressing qualification, and dissatisfaction with one's own activities, while Extraverts expressed more pleasure talk, agreement, and compliments, with content focusing more on extracurricular activities (Thorne, 1987). Extraverts

have also been shown to use more self-referent statements, and initiate more laughter (Gifford and Hine, 1994). Gifford and Hine also found that Extraverts talk more, with other studies finding that they use a greater total number of words (Campbell and Rushton, 1978; Carment, Miles, and Cervin, 1965). As would be expected, Extraverts show greater desire to initiate interactions (McCroskey and Richmond, 1990), even in computer-mediated communication (Yellen, Winniford, and Sanford, 1995). Also, Dewaele (2002) finds that in L3 English production, Extraversion (and also Psychoticism) showed a strong negative relationship to communicative anxiety, whilst Neuroticism showed a positive relationship.

Studies investigating hemispheric asymmetry provide a further perspective on this area, for example, Davidson (2001) proposes the relationship between Extraversion and positive affect with approach behaviours, and Neuroticism and negative affect and withdrawal behaviours. In the following hypotheses, we explore the implications of personality, affect and approach/withdrawal on priming behaviour.

Hypotheses for interpersonal priming

The likelihood of priming may be affected by the tendency to approach or the tendency to withdraw—or by both.

If Extraversion is associated with approach behaviours, it is natural to expect that higher Extraversion will lead to “more approach”, and that this might mean that an individual will coordinate more with their interlocutor. Furthermore, the Extravert's higher drive to gain or retain the conversational floor will mean that less effort can be directed towards detailed language planning. Hence, if their partner has made a lexical or syntactic choice, the High Extravert is likely to re-use that choice, rather than explicitly planning a new one (cf. Gill and Oberlander, 2003a).

If Neuroticism is associated with withdrawal behaviours, it could well be that high levels of this trait result in “more withdrawal” and lower engagement with the interlocutor. Furthermore, the inward (worrying) focus of a High Neurotic might mean that more resources are devoted to inner thought, and fewer to interaction with the environment. Thus, we might expect that such an individual will coordinate less with their interlocutor.

Thus, there is a clear prediction for Extraversion, and a slightly more complex picture for Neuroticism. Of course, it could be that neither Extraversion nor Neuroticism have any effect on coordination or priming.

Method

In syntactic priming, a particular syntactic structure is more likely to be produced given prior exposure to the same structure (Schenkein, 1980). This

phenomenon has been replicated under experimental conditions when speakers say, hear, or read sentences (e.g., Bock, 1986; Pickering and Branigan, 1998; Corley and Scheepers, 2002). Bock and colleagues found that people tended to repeat the active or passive form of a sentence they had just read in describing an unrelated picture (Bock, 1986; Bock, Loebell, and Morey, 1992). In this study we employ the confederate priming method (Pickering and Branigan, 1998): The subject of the experiment takes part in a dialogue game along with a confederate of the experimenter. The game involves matching and describing pictures. Both participants apparently have the same two tasks: to describe a set of pictures so that the other participant can match them, and to verify whether the descriptions that they hear match the picture that they see. However, the confederate's descriptions are scripted.

Participants

Forty University of Edinburgh students who were self-declared native speakers of English were paid to participate in this study. Personality information derived from the NEO-PI questionnaire is as follows: Extraversion $M = 51.75$ ($SD = 12.82$), and Neuroticism $M = 54.18$ ($SD = 12.72$).

Materials and Design

We prepared two sets of pictures depicting actions. Each set included 12 pictures depicting transitive actions involving an agent and a patient. The entities depicted were chosen to be easily recognisable and nameable. There were two pictures for each of 12 transitive verbs (*bite, chase, dust, hit, kick, lift, poke, pull, push, shoot, touch, weigh*). These 24 pictures comprised the set of targets. The remaining 120 pictures in each set depicted intransitive actions. There were several pictures for each of 20 intransitive verbs. These comprised the filler pictures.

The appropriate verb was printed under each action. Each set of pictures depicted the same range of entities and actions. However, the pairing of entities with actions was different.

We term one set the Subject's Description Set and the other set the Confederate's Description Set. We created ordered pairs of prime and target pictures by pairing each description of a transitive action from the Confederate's Description Set (the prime) with a picture depicting a transitive action from the Subject's Description Set (the target picture).

Half of the prime sentences were assigned active descriptions of the form 'the X verbing the Y', and half were assigned passive descriptions of the form 'the Y being verbed by the X'. An experimental item was defined as the confederate's scripted description of a prime picture plus the subject's target picture paired with it. There were thus two versions of each item: active confederate description and passive confederate description.

We constructed four lists containing 24 experimental items and 120 subject fillers. The confederate fillers were randomly distributed in the remaining gaps. The entities depicted in the target picture were not present in the immediately preceding block (prime plus subject fillers and confederate fillers). The verb also differed between prime and target. Each picture was assigned to either the match or the mismatch condition for the matching task. For the latter, we assigned another picture depicting a different entity doing the same action (thus using the same verb) was assigned. Each list contained 12 experimental items with active prime descriptions and 12 with passive prime descriptions. Exactly one version of each item appeared in each list. Hence, Prime Type (active vs. passive) was manipulated within subjects and items. The dependent measure was the proportion of descriptions of target pictures produced with a passive structure.

Procedure

The Subject's Description Set was presented to the subject via a computer program. The order of the pictures was randomised for each subject, with between four and eight filler items intervening between each experimental item. A divider prevented the subject from seeing the confederate or his computer screen. The experimenter told the subject and the confederate that the experiment was investigating how well people communicate when they cannot see each other. Their tasks were alternately to describe the pictures to the other participant, and to match their picture to the other participant's descriptions. When it was the subject's turn to match, the confederate would see a sentence appear on his screen which he would read aloud and then press space bar, at which point a picture would appear on the subject's screen. The subject was instructed to say "yes" or "no" (or ask for repetition) and to press the Z key for "no" and the M key for "yes" according to whether the picture matched or mismatched the description. When it was the subject's turn to describe, a picture would appear on the subject's screen and the confederate would say "yes" or "no" (or ask for repetition) and press the Z key or the M key according to whether the picture on his screen matched or mismatched the description. Throughout the session, the experimenter and confederate acted as if the confederate was a genuine subject (e.g., the confederate asked questions about the task). Before the experiment, there was a practice session with two filler items each, after which the subject could ask for clarification if necessary. The confederate also gave the first description. Hence the confederate's description of a prime always immediately preceded the subject's description of a target. Both dialogue participants wore a lapel microphone. The experimental session was recorded on audio tape and subsequently transcribed.

Table 1: Proportion of Passive target responses after active and passive primes and degree of priming

Group	Nos.	PP	AP	Priming
Low E	8	.1363	.0300	10.6
Mid E	27	.2015	.0270	17.5
High E	5	.1500	.0480	10.0
Low N	5	.1160	.0480	6.8
Mid N	28	.2271	.0261	20.1
High N	7	.0486	.0343	1.4
Total	40	.1820	.0302	15.2

We coded the first response that the subject produced; 3 target responses that described the agent as the patient and the patient as the agent were excluded. We coded the remaining target 957 responses as passive if the patient was described as being verbed by the agent and as active if the agent of the action was described as verbing the patient.

An analysis of variance (ANOVA) was conducted, with prime type (active vs. passive) as a within subjects factor and Neuroticism (Low [> -1 s.d. of the mean], Mid [< 1 s.d. of the mean], High [$> +1$ s.d. of the mean]) as a between subjects factor.

Results

Proportions of passive target responses following passive and active primes are reported in Table 1; these are described by personality type of participant, and also for the group overall. Here we can see that in both cases the Mid groups appear to show greater priming. However the High and Low Neurotic groups appear to show even lower levels of priming than for Extraversion.

Turning now to our analysis of variance, and here the ANOVA revealed a significant effect of prime type (active vs. passive) on the proportion of passive forms used ($F_1(1,37) = 6.63$; $p < 0.05$; $F_2(1,23) = 97.01$; $p < 0.05$).

A significant interaction was found between Neuroticism (Low, Mid or High) and prime type ($F_1(1,37) = 3.68$; $p < 0.05$). Post-hoc Tukey tests revealed that both the High N and Low N groups primed significantly less than the Mid N group ($p < 0.05$). No interaction was found between Extraversion and prime ($F_1(1,37) = 0.60$; $p > 0.1$).

Discussion

We found a reliable effect of syntactic priming of active and passive structures in a dialogue task. This confirms our expectations and replicates previous syntactic priming found in dialogue (e.g., Pickering and Branigan, 1998) and with active vs. passive forms (e.g., Bock, 1986).

Additionally, our results demonstrate that Neuroticism is related to the degree of syntactic priming for passive constructions; Extraversion is not.

We now relate these results to our hypotheses. For Extraversion, we proposed that higher levels of Extraversion would lead to an increase in priming. Here we found that the Mid group primed more, however this result was not significantly different to that of the Low and High groups. In this case we therefore accept the null hypothesis that Extraversion is not related to levels of priming. For Neuroticism, we find that the Low and High groups primed significantly less than the Mid group. Comparing this result directly with our Neuroticism hypothesis creates a tension: We proposed that the High group would be less likely to prime due to an inward focus and thus withdrawal from their partner. To address these findings, we therefore reframe our Neuroticism hypothesis as follows: as before, we claim that the High group are less likely to prime due to inward focus, but that the Low group are also less likely to prime, since they are less concerned with monitoring themselves in relation to their interlocutor. In this case—as in our results—the extreme High and Low levels of the trait have an inhibitory effect on priming, and the Mid trait levels represent a facilitating effect.

We acknowledge that such explanation is relatively speculative, and further experimentation will be required to test this hypothesis. For example, the NEO-PI questionnaire divides Neuroticism into 6 facets: anxiety, angry hostility, depression, self-consciousness, impulsivity, vulnerability. It may be that these may relate more specifically to withdrawal or threat-monitoring, in which case these could be related to the priming information. However, we expect that a larger experimental population would be required for such work. For Extraversion, no significant pattern emerges, however we propose that the extremes are similarly inhibited by over- or under-other-directedness.

Turning now to the significance of our findings, and they have several important implications. At a theoretical level, they provide more data about personality behaviour in dialogue contexts, which extend previous research using monologue data. Additionally this can better inform our understanding of personality in relation to models of language production.

Our results also contribute to the dialogue and priming literature which, for example, acknowledge that individuals often behave differently, but that systematic variation has mainly been examined in sociological terms. Here we have presented data which shows real and important differences between individuals in conversational behaviour, and highlights the potential role of personality in priming experimentation, more generally.

Finally, our findings can be used to directly inform dynamic computer interface technology, which could allow linguistic alignment in a realistic way. For example, Nass, Moon, Fogg, and Reeves (1995) have shown that computer users viewed their ma-

chine more favourably when it mirrored their personality. On the basis of work reported here, we are closer to being able to represent personality at the conversational, interactive level. We therefore anticipate that this will lead to more convincing artificial agents and intelligent dynamic computer interfaces.

These findings also nicely complement those presented by Branigan, Pickering, Pearson, McLean, and Nass (2003), in which computer users syntactically align with a pre-programmed computer interface, whether they believed this to be another person or an 'unintelligent computer'. Therefore, if such an 'unintelligent computer' was to project personality, we may expect it to vary its degree of priming—in addition to its lexicon—depending upon the sort of personality it may wish to project.

Conclusion

We have used experimental priming data to investigate the influence of personality on interpersonal language behaviour. Proposing hypotheses which suggested both Extraversion and Neuroticism influence linguistic coordination, here we found that the less interpersonal trait—Neuroticism—surprisingly influenced priming, whilst Extraversion did not. Given our finding that priming is facilitated by moderate Neuroticism, but inhibited by more extreme levels, we explain this in terms of withdrawal by building upon a previously proposed model of personality and language production. Issues regarding the significance and potential implications of this study are also discussed.

Acknowledgements

The first and second authors gratefully acknowledge support from the UK Economic and Social Research Council and the School of Informatics. We also express our gratitude to Holly Branigan, Sarah Haywood, Alan Marshall, Janet McLean, Martin Pickering and Matt Watson for help and advice with the study.

References

- Bell, A. (1984). Language as audience design. *Language in Society*, **13**, 145–204.
- Bock, J. (1986). Syntactic persistence in language production. *Cognitive Psychology*, **18**, 355–387.
- Bock, J. K., Loebell, H., and Morey, R. (1992). From conceptual roles to structural relations: Bridging the syntactic cleft. *Psychological Review*, **99**, 150–171.
- Bradac, J. and Wisegarver, R. (1984). Ascribed status lexical diversity, and accent: Determinants of perceived status, solidarity, and control of speech style. *Journal of Language and Social Psychology*, **3**, 239–255.
- Branigan, H., Pickering, M., and Cleland, A. (2000). Syntactic coordination in dialogue. *Cognition*, **75**, B13–B25.
- Branigan, H., Pickering, M., Pearson, J., McLean, J., and Nass, C. (2003). Syntactic alignment between computers and people: The role of belief about mental states. In *Proceedings of the 25th Annual Conference of the Cognitive Science Society*, pages 186–191.
- Brennan, S. E. and Clark, H. H. (1996). Conceptual pacts and lexical choice in conversation. *Memory and Cognition*, **22**, 1482–1493.
- Campbell, A. and Rushton, J. (1978). Bodily communication and personality. *British Journal of Social and Clinical Psychology*, **17**, 31–36.
- Carment, D. W., Miles, C. G., and Cervin, V. B. (1965). Persuasiveness and persuasibility as related to Intelligence and Extraversion. *British Journal of Social and Clinical Psychology*, **4**, 1–7.
- Cope, C. (1969). Linguistic structure and personality development. *Journal of Counselling Psychology*, **16**, 1–19.
- Corley, M. and Scheepers, C. (2002). Syntactic priming in English sentence production: Categorical and latency evidence from an internet-based study. *Psychonomic Bulletin and Review*, **9**, 126–131.
- Costa, P. and McCrae, R. R. (1992). *NEO PI-R Professional Manual*. Psychological Assessment Resources, Odessa, Florida.
- Coupland, N. (1980). Style-shifting in a Cardiff work-setting. *Language in Society*, **9**, 1–12.
- Davidson, R. J. (2001). Toward a biology of personality and emotion. *Annals of the NY Academy of Sciences*, **935**, 191–207.
- Dewaele, J.-M. (2002). Psychological and sociodemographic correlates of communication anxiety in L2 and L3 production. *International Journal of Bilingualism*, **6**, 23–28.
- Dewaele, J.-M. and Furnham, A. (1999). Extraversion: The unloved variable in applied linguistic research. *Language Learning*, **49**, 509–544.
- Dewaele, J.-M. and Furnham, A. (2000). Personality and speech production: a pilot study of second language learners. *Personality and Individual Differences*, **28**, 355–365.
- Eysenck, H. and Eysenck, S. B. G. (1991). *The Eysenck Personality Questionnaire-Revised*. Hodder and Stoughton, Sevenoaks.
- Eysenck, S., Eysenck, H., and Barrett, P. (1985). A revised version of the psychoticism scale. *Personality and Individual Differences*, **6**, 21–29.
- Garrod, S. and Doherty, G. (1987). Saying what you mean in dialogue. *Cognition*, **27**, 181–218.
- Gifford, R. and Hine, D. W. (1994). The role of verbal behaviour in the encoding and decoding of

- interpersonal dispositions. *Journal of Research in Personality*, **28**, 115–132.
- Gill, A. (2003). *Personality and Language: The projection and perception of personality in computer-mediated communication*. Ph.D. thesis, University of Edinburgh, Edinburgh, UK.
- Gill, A. and Oberlander, J. (2002). Taking care of the linguistic features of extraversion. In *Proceedings of the 24th Annual Conference of the Cognitive Science Society*, pages 363–368.
- Gill, A. and Oberlander, J. (2003a). Looking forward to more extraversion with n-grams. In L. Lagerwerf, W. Spooren, and L. Degand, editors, *Determination of Information and Tenor in Texts: Multiple Approaches to Discourse 2003*, pages 125–137. Stichting Neerlandistiek & Nodus Publikationen, Amsterdam & Münster.
- Gill, A. and Oberlander, J. (2003b). Perception of e-mail personality at zero-acquaintance: Extraversion takes care of itself; Neuroticism is a worry. In *Proceedings of the 25th Annual Conference of the Cognitive Science Society*, pages 456–461.
- Haywood, S., Pickering, M., and Branigan, H. (2003). Co-operation and co-ordination in the production of noun phrases. In *Proceedings of the 25th Annual Conference of the Cognitive Science Society*, pages 533–538.
- Labov, W. (1972). *Sociolinguistic Patterns*. University of Pennsylvania Press, Philadelphia.
- Matthews, G. and Deary, I. (1998). *Personality Traits*. Cambridge University Press, Cambridge.
- McCroskey, J. and Richmond, V. (1990). Willingness to communicate: A cognitive view. *Journal of Social Behaviour and Personality*, **5**, 19–37.
- Nass, C., Moon, Y., Fogg, B., and Reeves, B. (1995). Can computer personalities be human personalities? *International Journal of Human-Computer Studies*, **43**, 223–239.
- Pennebaker, J. W. and King, L. (1999). Linguistic styles: Language use as an individual difference. *Journal of Personality and Social Psychology*, **77**, 1296–1312.
- Pickering, M. and Branigan, H. (1998). The representation of verbs: Evidence from syntactic priming in language production. *Journal of Memory and Language*, **39**, 633–651.
- Pickering, M. and Garrod, S. (in press). Towards a mechanistic psychology of dialogue. *Behavioural and Brain Sciences*.
- Schenkein, J. (1980). A taxonomy for repeating action sequences in natural conversation. In B. Butterworth, editor, *Language production*, volume 1, pages 21–47. Academic Press, London.
- Scherer, K. R. (1978). Inference rules in personality attribution from voice quality: The loud voice of extraversion. *European Journal of Social Psychology*, **8**, 467–487.
- Siegmán, A. W. (1987). The tell-tale voice: Non-verbal messages of verbal communication. In A. Siegmán and S. Feldstein, editors, *Nonverbal behaviour and communication*, pages 642–654. Erlbaum, Hillsdale, NJ.
- Thorne, A. (1987). The press of personality: A study of conversations between introverts and extraverts. *Journal of Personality and Social Psychology*, **53**, 718–726.
- Yellen, R., Winniford, M., and Sanford, C. (1995). Extraversion and introversion in electronically-supported meetings. *Information & Management*, **28**, 63–74.